# The Focus-Filter Widget:
# A Versatile Control for Defining Focus + Context in 1D


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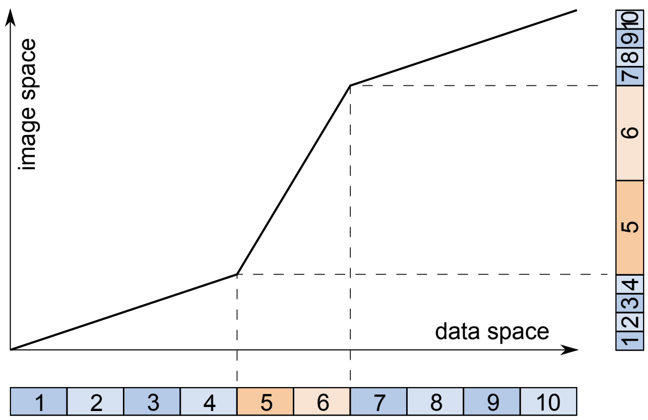


Figure 1: Piecewise-constant magnification for a distorted projection of data space to image space (compare to [7]).


### Abstract

Spatial Focus + Context is a well-established concept in Information Visualization, but the definition is often visualization-specific or involves multiple GUI components. This poster describes the focus-filter widget, a versatile and intuitive control element that combines dynamic data filtering and Focus + Context in 1D. The widget embeds a focus handle in a well-known range-slider for defining the location and the extent of a focus range as well as the degree of spatial distortion. We illustrate the focus-filter widget based on an application to different types of visualizations which demonstrates its portability and potential to simplify the user interface.



**Index Terms:** H.5.2 [Multimedia Information Systems]: User Interfaces—Graphical user interfaces (GUI)


## 1 Introduction and Motivation

Focus + Context (F+C) techniques have long been established as a proven concept to provide an overview and details at the same time [4]. While F+C is a general concept [2], we address spatial distortion-oriented techniques which distribute more space to data *in focus* and less to data *in context*. Interaction approaches to specify the degree of interest function underlying the definition of focus and context are often visualization-dependent or involve multiple control elements (e.g., [3]).


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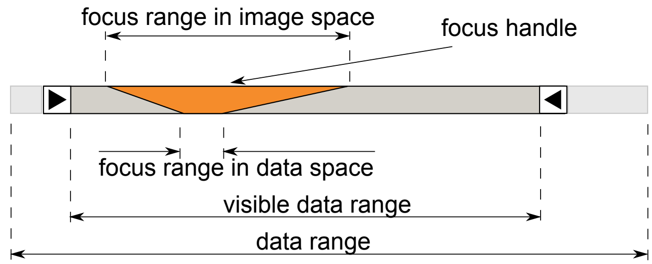


Figure 2: The focus-filter widget embeds a zoom handle in a range-slider. The arrows can be dragged to specify a visible range inside the total data range. The zoom handle defines the location and the extent of a focus range within the visible range as well as the degree of spatial distortion.

The goal of our work was to design a compact yet intuitive widget for specifying a piecewise-constant magnification [4] with one focus (see Figures 1 and 2). This widget should support the specification of the location and extent of the focus as well as the degree of spatial distortion. It should also be generally applicable to visualizations that benefit from spatial F+C in 1D.

## 2 The Focus-Filter Widget

Our key idea is to embed an interactive focus handle in a common range-slider to specify and control a *focus range* inside the visible range (see Figure 2). We refer to a range-slider as a control element to define the location and the size of a visible range within a continuous data range. In visualization, it is often used for dynamic data filtering [1].

The focus range is visually represented by two lines which indicate its borders. These lines show the location and proportional size of the focus range within the visible range, both in data space (i.e., undistorted) and in image space (i.e., distorted). The skewness of the borders thus represents the degree of distortion. This degree is additionally conveyed by color using a linear transfer function that maps “no distortion” to white and “maximal distortion” (i.e., the focus range fully covering the image space) to orange. The distortion itself is based on a piecewise-linear visual transfer function that assigns the same scale factor to the context on either side of the focus (see Figure 1).

For interaction, the representation of the focus range can be seen as a handle that supports the following user interactions:

- Clicking the focus handle and dragging the mouse orthogonally to the orientation of the widget modifies the magnification factor
- Clicking the focus handle and dragging the mouse along the slider axis moves the focus range inside the visible range
- Clicking and dragging the focus handle’s borders increases or decreases the size of the focus range without changing the distortion factor
- Double-clicking the handle resets the distortion

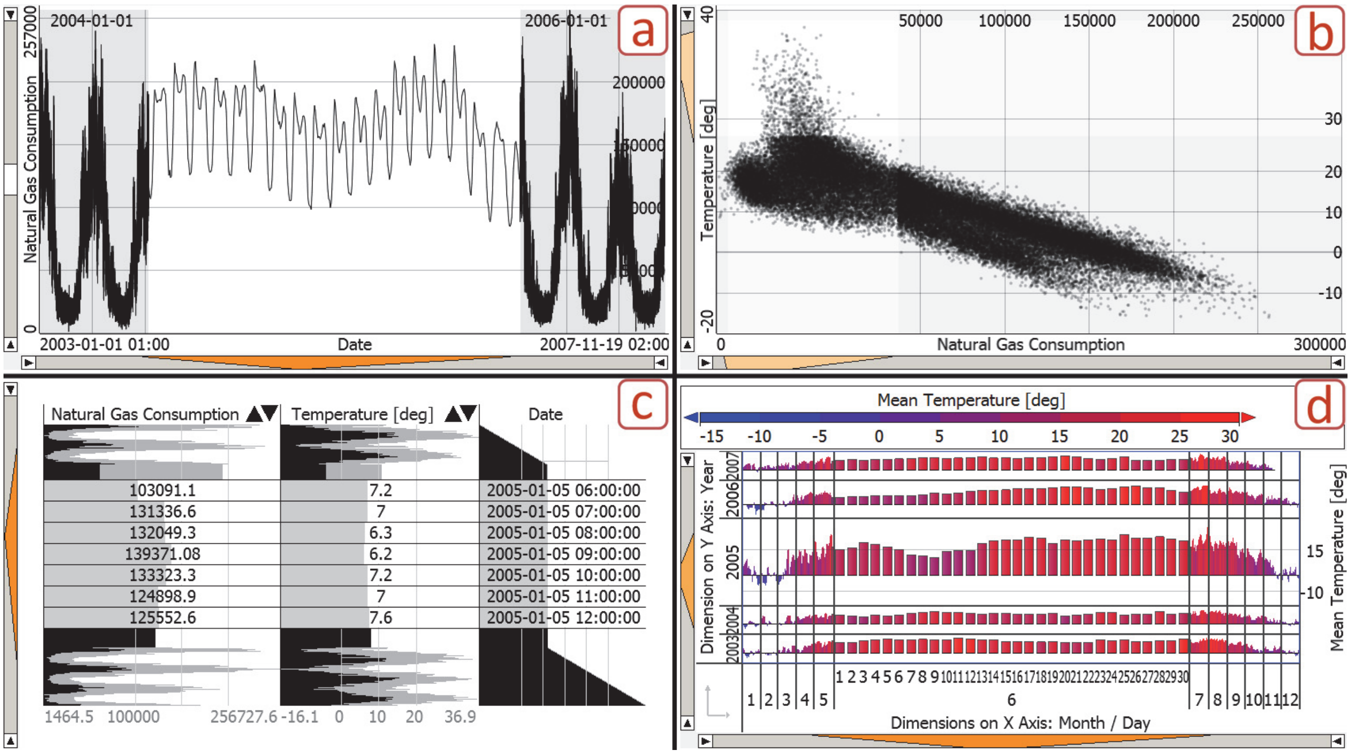


Figure 3: Application of the focus-filter widget to a sample analysis of natural gas consumption [5] in four different visualizations showing its applicability to continuous scales (a,b) and discrete elements (c,d). (a) Natural gas consumption over time. The distortion shows daily patterns in context of five years. (b) The zoomed region of the 2D scatter plot focuses on high temperatures and low consumption. (c) Application to a table lens view. (d) Application to a small-multiples visualization displaying years (Y-axis) and months (X-axis).

Per default, modifying the magnification factor affects the degree of distortion but does not change the proportion of focus and context in data space. For a large focus range, however, increasing the distortion quickly reduces the size of the context in image space to almost zero while still limiting the achievable magnification of the focus. As a solution, we limit the maximal extent of the focus in image space. Increasing the magnification further is possible but reduces the size of the focus in data space instead. This also helps to define very small focus ranges.

Figure 3 shows the use of the focus-filter widget in different views of the visualization framework *Visplore*[5, 6]. It illustrates the application to continuous ranges as well as to discrete visual elements like table rows and small-multiples visualizations.

## 3 Discussion and Conclusion

The focus-filter widget enables a flexible definition of focus and context while retaining intuitive controls. It does not occupy more screen space than a common range slider and is widely applicable to numerous types of visualizations.

A limitation of the focus-filter widget stems from the interactive definition of the visible and focal ranges in screen space. Even one pixel may correspond to a range which is too large in data space. To address this problem, the user may set the currently visible range as new data range via a double click. Similarly, the user can restore the initial data range.

Another restriction is the decision to support a *single* coherent focus range per slider. While multiple focus ranges may sometimes be beneficial, we decided against adding this additional complexity to potentially facilitate the learning and adoption by real users.

As part of the visualization framework Visplore, the focus-filter widget has been deployed to dozens of users in the automotive industry and the energy sector for more than two years (see, among others, [5, 6]). Informal feedback has been very positive and users make frequent use of the spatial distortion. A common request was the addition of textual controls for a precise definition of ranges, which we support via a context menu. As future work, we plan to conduct a controlled user study to evaluate the focus-filter widget more formally and to identify further improvements.

## References


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